

基于局部特征的图像指纹技术研究

摘要

随着数字媒体技术的飞速发展,针对数字媒体内容的数字版权管理技术的需求也日益迫切。数字版权管理技术已经成为数字媒体技术发展的一个瓶颈。本文总结分析了现有数字版权管理(DRM)技术路线的不足,根据当前的数字媒体用户的需求,总结逐渐成型的 DRM 理念,得出了基于媒体指纹的 DRM 技术实现方案。然后以图像为研究对象,我们对指纹辨识 DRM 系统关键技术进行了深入研究。

本文主要创新工作如下:

1. 以图像作为研究对象,研究基于指纹辨识的 DRM 技术实现方案中的关键技术——图像指纹提取和匹配算法。在回顾分析了已有相关算法之后,我们针对现有图像指纹辨识算法的不足,采取基于局部特征生成图像指纹的方法,有效抵抗图像局部修改类型,从而很好的弥补已有相关算法的不足;

2. 在局部特征生成的图像指纹的基础上,利用图像对已匹配特征点之间的几何同构关系,设计匹配算法来检测同源性,实验结果证明,我们设计的基于局部特征的图像指纹辨识算法能有效抵抗如剪切、组合等会改变图像全局特征的修改类型。

3. 为了让算法对更复杂的图像几何修改保持鲁棒,我们对匹配算法进行了改进,利用仿射变换的重要性质,重新设计匹配算法。我们将改进后的算法在万幅原始图像数据集上进行实验,结果证明,我们所设计的基于局部特征的图像指纹辨识算法,对复杂的几何修改有着很好的效果,比已有方法有着明显优势。

关键词: 数字版权管理; 图像指纹; 局部特征; 媒体指纹辨识系统

Research on Local Feature-based Image Fingerprinting Technology

Yu Xinghua (Computer Application)

Directed By Huang Tiejun

With the fast development of digital media technology, Digital Rights Management (DRM) has become an emergent requirement. DRM technology is becoming the bottleneck of digital media technology. In this thesis, we conclude and analyse the existing DRM technical routes and reach the conclusion that all of them have underlying shortages. We analyse the deficiencies of existing DRM technologies, the demands of digital media users, and then conclude the new DRM concept appearing recently. According to the new DRM concept, we research on the Media Fingerprinting-based DRM implementation scheme. With images as the research object, we make deep research on key technologies of Image Fingerprinting System.

The main creative contributions of this thesis are as follows:

1. With image as the research object, we research the key technologies of Image Fingerprinting System: image fingerprint extracting algorithm and fingerprint matching algorithm. After reviewing the existing image fingerprinting algorithms, we find most of them can not deal with geometric modifications. Aiming at this problem, we propose the local feature-based image fingerprint.

2. Basing on the local feature based image fingerprint, we design matching algorithm to detect homologous relationship between image pairs. The matching algorithm benefits from the geometric isomorphic relationship existing among feature points. Experimental results show that the proposed image fingerprinting algorithm can resist effectively those modifications which can change global features of images.

3. In order to be robust to more complex geometric modifications, we make improvement to the matching algorithm with important property of affine transformation. After testing our image fingerprinting algorithm on dataset that contains 10000 original images, we prove that our method can deal with complex geometric modifications much better than existing algorithms.

Keywords: Digital Rights Management, Image Fingerprint, Local Feature, Media Fingerprinting System